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Research Group Bulletin

The role of the Hauser-Davis Research Group - ChemBio: Environmental Studies at the Chemical-Biological Interface in furthering Brazilian Science within a One Health and conservationist context

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Abstract

This paper presents a brief history of the Hauser-Davis Research Group (HDRG), currently based at the Oswaldo Cruz Foundation (Fiocruz), and its current mission, goals, and main research activities.

Keywords: HDRG; Research Group, Chemical-Biological Interface; One Health; Conservation.

The Hauser-Davis Research Group (HDRG) (Figure 1) was born from the ideals of an English-Brazilian researcher based in Brazil who saw the lack of interest in studies within the Chemical-Biological Interface in the country in the mid 2010's as an opportunity to bring together these fields of knowledge to further Brazilian Science on several fronts. The group was founded in the state of Rio de Janeiro, Brazil by Dr. Rachel Ann Hauser-Davis, a biologist with a PhD degree in chemistry, and is registered at the National Council for Scientific and Technological Development (CNPq) research group directory under the name Hauser-Davis Research Group with the addendum ChemBio: Environmental Studies at the Chemical-Biological Interface (in Portuguese: *QuiBio: Estudos Ambientais na Interface Química-Biológica*) (http://dgp.cnpq.br/dgp/espelhogrupo/701873) to denote the importance of this multidisciplinary approach in an increasingly devastated, unequal and greed-driven world.

HDRG projects permeate very diverse fields of knowledge, such as Biological Oceanography, Physiology, Environmental Chemistry, Ecotoxicology, Food Safety, (Metallo)Proteomics, Natural and Fishery Resource Conservation and Environmental Education. These lines of research fall within the priority area of Sustainable Development and Quality of Life, according to Ordinance No. 1.122/2020 established by the Brazilian Ministry of Science, Technology, Innovations and Communications (MCTI), contributing directly to several Sustainable Development Goals (SDG) established by the 2030 Agenda for Sustainable Development, such as the SDG 4 (quality education to achieve innovation, dissemination and socio-environmental dimensions), SDG 6-6 (protect and restore aquatic ecosystems), SDG 14-2 (protect and restore marine ecosystems), SDG 14-5 (conserve coastal and marine areas) and SDG 14-A (increase scientific knowledge, research and technology for the health of the oceans). The group's members are located in different Brazilian states and regions, as well as in different countries, comprising specialists in different areas, each bringing her or his expertise to our projects.

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Figure 1. Part of the Hauser-Davis Research Group's current team.

Photo by Gutemberg Brito

Within this context, the HDRG directly applies the One Health concept in most of its projects. This still recent approach concept recognizes the interconnectivity between humans, animals, plants, and their shared environments, comprising a collaborative, multisectoral and transdisciplinary approach at local, regional, national, and global levels. The most noteworthy approach applied by the HDRG in this regard consists in a direct application to environmental conservation in a scenario of continuous loss of biodiversity, considered the basis for human health, due to different anthropogenic activities, leading to habitat degradation, resource overexploitation, pollution, invasive alien species and climate change, among many others. It is important to note that several significant negative impacts on socioeconomic and cultural activities and Public Health, mainly loss of economic, social, and environmental benefits, jointly called ecosystem services, occur from the loss of biodiversity, all of which are evaluated in the group's projects. In this regard, projects have been conducted on both chronic and acute effects of oil spills and mine tailings dam ruptures on aquatic biota and vegetation. In fact, the HDRG has conducted many biomonitoring assessments concerning different pollutants in Brazilian fauna members. These include both classic contaminants (metals, polychlorinated biphenyls, polybrominated diphenyl ethers, polycyclic aromatic hydrocarbons) and contaminants of emerging concern (pharmaceuticals, nanomaterials, understudied metals such as rare earth elements, titanium, and rubidium) in coastal and oceanic areas. In addition to contaminant levels, we also routinely evaluate sublethal effects through biochemical and chemical biomarkers with emphasis on unprecedented assessments concerning biochemical detoxification routes in Neotropical animals, aiming to carry out ecological risk assessments. In many cases we have also reported baseline data, as no studies on certain species or contaminants were available until our group's assessments.

One of the HDRG's main interests lies in subcellular metal compartmentalization and their detoxification through the metalloprotein biochemical pathway, as well as the biochemical responses and biomorphometric effects of exposed organisms, seeking to understand the effects of different pollutants on the health, development, survival, fertility, and ecology of the studied organisms. Human risks associated with the consumption of contaminated seafood are also assessed. Furthermore, several of the group's research efforts specifically consider the fact that ecotoxicological studies have mainly focused on temperate species organismal responses, neglecting tropical species, and native Brazilian species in particular. Moreover, Brazil displays a richness of still understudied tropical estuarine species and we have made it our mission to attempt to further knowledge on these important ecosystem resources in the country in these specific environments.

On the conservationist side of things, HDRG efforts have also focused on several species threatened with extinction, mainly megafauna members, such as elasmobranchs (sharks, rays, and chimaeras, Figure 2), chelonians (marine turtles), and marine mammals (sirenians, pinnipeds and cetaceans), as well as many mangrove species. With this, we have increasingly furthered knowledge on baseline contaminant levels and physiological responses, which are, in many instances, still lacking in Brazil mainly due to logistic difficulties, directly associated to lack of government funding in recent years. This approach, also based on a One Health context, considers that awareness concerning chemical contamination of threatened and consumed animals may lead consumers to reduce their consumption, comprising and indirect conservation strategy.

The HDRG also aims to carry out Scientific Dissemination efforts, leading to the democratization and popularization of scientific knowledge, which is still unfortunately commonly restricted to the academia. In this regard, we

report our results not only in scientific journals and events, but also to the lay public in the form of social media posts in the groups Instagram (https://www.instagram.com/hauserdavis_group/) and Facebook (https://www.facebook.com/hauserdavisresearchgroup) pages, as well as in the Children's Science Today magazine (in Portuguese: *Ciência Hoje das Crianças*), one of the most important scientific dissemination vehicles in Brazil. Allied to this, we aim to raise awareness on the conservation of threatened aquatic organisms through lectures and the development of different educational materials, used to translate research findings into easy to understand and engaging stories in the form of coloring books and educational booklets, all extremely relevant and paramount in conservation actions.

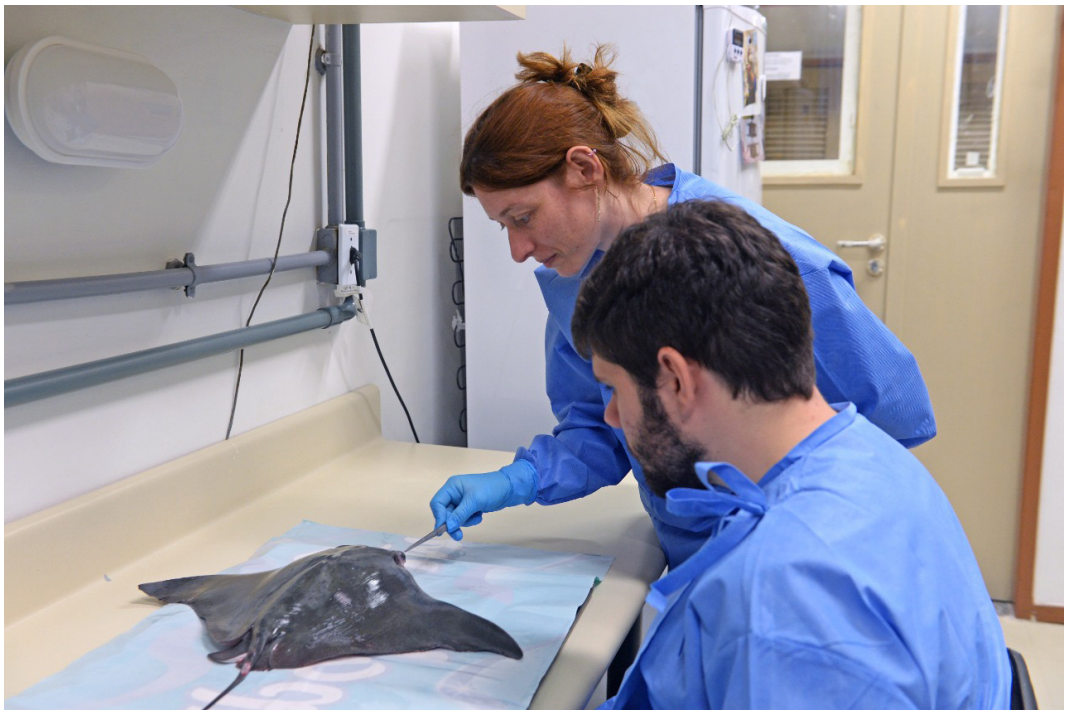

Figure 2. Elasmbranch dissection carried out by Hauser-Davis Research Group's leader Dr. Rachel Hauser-Davis and a team member.

Photo by Gutemberg Brito

Reflecting gender and race pro-equity diversity values, with the aim of strengthening and valuing ethnic-racial and gender issues and making gender equity, sexual diversity, and ethnic-racial relations a priority, the HDRG makes a point to include several minorities within the group's activities, including LGBTQIA+, people of colour, low-income minorities, and female researchers with children from all backgrounds. It is particularly important to highlight two members of our group in this regard. The first is Dr. Isabella Bordon, an ambassador for the Parent in Science movement, a movement that emerged in 2016 with the aim of raising discussions on parenthood within the Science universe in Brazil and ensuring that mothers remain enrolled in higher education, and complete their courses, comprising one of the fundamental actions to combat the "scissors effect", that demonstrates that the number of women in science decreases with career progression. Dr. Isabella's work in this regard is paramount to reduce the huge gap for mothers in Science in all possible ways, from respect to inclusion. The other member is Dr. Natascha Wosnick, a founding member of the "ElasMulheres" group, composed only of Brazilian women who work in elasmobranch research, which is still extremely scarce in Brazil. This research field, as well as others that demand field work and direct contact with mostly male actors (fishers, for example) bring significant challenges for female researchers in a mainly male-dominated field, and "ElasMulheres" efforts in this regard are paramount for this field in the country. In addition, Dr. Natascha's research and educational efforts are also vital in furthering the elasmobranch field in Brazil, even more so comprising a female-led research group.

On a more personal note, The HDRG coordinator, Dr. Rachel Ann Hauser-Davis was recently invited to become Editor-in-Chief of a new scientific journal, Journal of Trace Elements and Minerals, in an effort to diversify scientific journal editors, as women still make up very low percentages of Editor-in-Chief roles in scientific journals. Employing this position as a stepping stone to further women diversity in science, a Virtual Special Issue (VSI) was prepared in this journal entitled "Empowering women in environmental sciences: Recent reports on metals and minerals", edited by two female scientists, the aforementioned Dr. Isabella Bordon and her colleague Dr. Mariana Capparelli. This VSI aimed to support teams coordinated by women and those that identify as women, also creating an open space for discussions regarding the role of women as leaders in caring for the environment, such as leaders of indigenous or any native communities. The

published manuscripts were all be authored by a woman as either first author or last author, and women granted parental leave by their institution or financial support agencies were encouraged to detail this in the acknowledgments section. The HDRG views this as paramount in creating inclusion and diversity in this academic space and is keen on furthering this type of effort.

We hope the HDRG will be active for many years to come, contributing towards furthering Science in all ways possible.

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